



**TIM O'HARE ASSOCIATES**  
SOIL & LANDSCAPE CONSULTANCY

T. Loughman & Co Ltd  
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3<sup>rd</sup> December 2015  
Our Ref: TOHA/15/6520/2/SS  
Your Ref: T5121/15014

Dear Sirs

**Bridgewater Road, QEOP**

**Imported Soil Analysis – High Permeability Turf Soil**

We have completed the analysis of the *High Permeability Turf Soil* sample collected from the Bridgewater Road, Queen Elizabeth Olympic Park site and have pleasure reporting our findings.

The purpose of the analysis was to determine the sample's compliance with the requirements of *2.5 Materials Selection – High Permeability Turf Soil* as listed in the T Loughman & Co Ltd Inspection & Test Plan – *Remediation, Bulk Excavation and Fill ITP, Olympic South Park* (ref: 15/014/12 ITP 01). The results for potential contaminants have been assessed against the Atkins *Site-Specific Assessment Criteria (SSACs) – Human Health Separation Layer for Zone PDZ8/CZ8c, Allotments*.

**Sampling**

The high permeability turf soil was examined and sampled at the Bridgewater Road Allotment site, Queen Elizabeth Olympic Park on 17/11/2015 by f Tim O'Hare Associates LLP (TOHA). It is understood that the soil was originally supplied by H. Sivyer Transport Ltd.

At the time of TOHA's visit, the High Permeability Turf Soil had been placed in a section of the site intended for amenity grass turfing. The soil was sampled from a total of 3 no. trial holes, using a spade and hand-driven soil auger. The locations of each trial hole are indicated on the attached site plan.

The turf soil at each location was consistent in visual appearance and described as:

Dark yellowish brown (Munsell Colour 10YR 4/4), slightly moist, friable SAND with a single grain and weakly developed fine granular structure. The soil was virtually stone-free, and contained occasional organic fines. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

A total of 1 No. representative sample was taken to undergo laboratory analysis.

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Plate 1: High Permeability Turf Soil area



Plate 2: Typical trial hole

### **ANALYTICAL SCHEDULE**

The sample was submitted to the laboratory for a range of physical and chemical analyses in accordance with the requirements of the specification. The following parameters were determined:

- Visual examination to record Munsell colour, moisture status, aerobic state, the presence of any deleterious materials, unusual odours (e.g. petroleum hydrocarbons);
- detailed particle size analysis;
- stone content (>2mm, >20mm, >50mm);
- permeability and porosity;
- pH value;
- electrical conductivity values (water and CaSO<sub>4</sub> extracts);
- exchangeable sodium percentage;
- organic matter content;
- total nitrogen;
- carbon:nitrogen ratio;
- extractable phosphorus, potassium and magnesium;
- phytotoxic contaminants (Cu, Ni, Zn);
- water-soluble boron, water soluble sulphate and total sulphate;;
- limiting values for harm to human health (ref: SSACs);

The results of this process are presented on the attached Certificate of Analysis, and a summary of our findings is provided below.

### **RESULTS OF ANALYSIS**

We have cross-referenced the results against the requirements of 2.5 *Materials Selection – High Permeability Turf Soil – Remediation, Bulk Excavation and Fill ITP, Olympic South Park* (ref: 15/014/12 ITP 01) and the *Site-Specific Assessment Criteria (SSACs) for Zone PDZ8/CZ8c*.



### Horticultural Parameters

The sample was not fully compliant with the requirements of 2.5 *Materials Selection – High Permeability Turf Soil*, on account of the following non-compliances:

Parameter	Result	Specified Requirement
Medium Sand (0.25-0.50mm)	36%	50 – 65%
Very Coarse Sand (1.0-20.mm)	16%	<5%
Stones (>2mm)	3%	0%
Permeability	1.1 mm/hr	150-300 mm/hr
Air Filled Porosity	8.7%	15-30%
pH Value	pH 8.5	pH 5.5-8.0
Organic Matter	3.2%	1.5-2.5%

A number of these non-compliances are a significant departure from the specification, and in particular the medium sand and very coarse sand contents, the permeability rate and the organic matter content.

However, we understand that the sample represents a manufactured topsoil that is to be used for amenity grass establishment in an informal lawn area within the allotment. This specification, which was originally written by Tim O'Hare Associates for the Olympic Delivery Authority, is intended for high-use, high foot trafficking lawn areas, such as the spectator lawns within the Olympic Park, where it would be supported by automatic irrigation. This specification is therefore not considered to be ideal for the amenity grass areas of this allotment development, where a lower footfall is anticipated and where the levels of maintenance (including irrigation) will probably be less.

As such, the composition of this sample, including its slightly broader particle size distribution and higher organic matter content, would be advantageous. Likewise, the slower permeability rate should help reduce the risk of drought stress. On these assumptions and considerations, we regard the topsoil represented by this sample to be suitable for the intended end-use.

### Chemical Parameters – SSACs

Of the potential contaminants determined, none were recorded at levels that exceeded their respective specified maximum permissible values

We hope this report meets with your approval and provides the necessary information. Please do not hesitate to contact the undersigned if we can be of further assistance.

Yours faithfully,

BSc MSc MSoilSci MBIAC CSci  
Principal Consultant

For & on behalf of Tim O'Hare Associates LLP

ТНХ

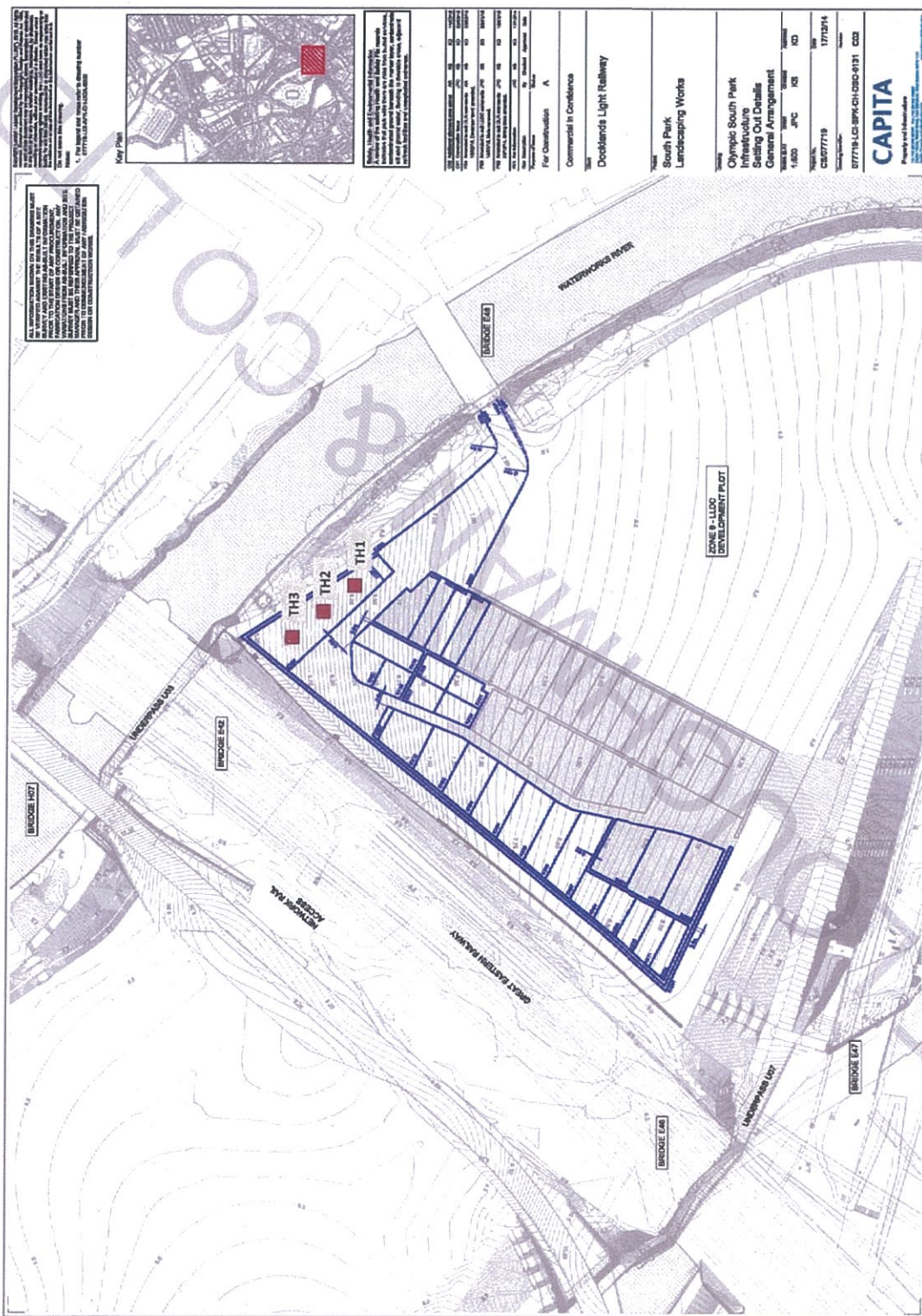
Approximate Trial Hole  
location



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Client:			
Project:	Bridgewater Road		
Job ref no.:	TOHA/15/65202/JSS		
Drawing no.:	6520/2		
Drawing title	High Permeability Turf Soil Validation		
Date:	Nov '15	Scale:	NTS
Drawn by:	IG	Checked by:	TOH

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Client:	T Loughman & Co Ltd
Project	Bridgewater Road, QEOP
Job:	Soil Validation Testing
Soil Type:	2.5 Material Selection - High Permeability Turf Soil
Date:	03/12/2015
Job Ref No:	TOHA/15/6520/2/SS



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Sample Reference		Accreditation
Clay (<0.002mm)	%	UKAS
Silt (0.002-0.05mm)	%	UKAS
Very Fine Sand (0.05-0.15mm)	%	UKAS
Fine Sand (0.15-0.25mm)	%	UKAS
Medium Sand (0.25-0.50mm)	%	UKAS
Coarse Sand (0.50-1.0mm)	%	UKAS
Very Coarse Sand (1.0-2.0mm)	%	UKAS
Total Sand (0.05-2.0mm)	%	UKAS
Texture Class (UK Classification)	--	UKAS
Stones (>2mm)	% DW	GLP
Stones (>20mm)	% DW	GLP
Stones (>50mm)	% DW	GLP

Permeability	mm/hr	A2LA
Total Porosity	%	A2LA
Air Filled Porosity	%	A2LA

pH Value (1:2.5 water extract)	units	UKAS
Electrical Conductivity (1:2.5 water extract)	uS/cm	UKAS
Electrical Conductivity (1:2 CaSO4 extract)	uS/cm	UKAS
Exchangeable Sodium Percentage	%	UKAS

Organic Matter (LOI)	%	UKAS
Total Nitrogen (Dumas)	%	UKAS
C : N Ratio	ratio	UKAS
Extractable Phosphorus	mg/l	UKAS
Extractable Potassium	mg/l	UKAS
Extractable Magnesium	mg/l	UKAS

Total Arsenic (As)	mg/kg	MCERTS
Total Cadmium (Cd)	mg/kg	MCERTS
Total Chromium (Cr)	mg/kg	MCERTS
Chromium (hexavalent)	mg/kg	MCERTS
Total Copper (Cu)	mg/kg	MCERTS
Total Lead (Pb)	mg/kg	MCERTS
Total Mercury (Hg)	mg/kg	MCERTS
Total Nickel (Ni)	mg/kg	MCERTS
Total Selenium (Se)	mg/kg	MCERTS
Total Zinc (Zn)	mg/kg	MCERTS
Water Soluble Boron (B)	mg/kg	MCERTS
Total Cyanide (CN)	mg/kg	MCERTS
Free Cyanide	mg/kg	MCERTS
Total (mono) Phenols	mg/kg	MCERTS
Water Soluble Sulphate	g/l	MCERTS
Total Sulphate	mg/kg	MCERTS

	mg/kg	MCERTS
Naphthalene	mg/kg	MCERTS
Acenaphthylene	mg/kg	MCERTS
Acenaphthene	mg/kg	MCERTS
Fluorene	mg/kg	MCERTS
Phenanthrene	mg/kg	MCERTS
Anthracene	mg/kg	MCERTS
Fluoranthene	mg/kg	MCERTS
Pyrene	mg/kg	MCERTS
Benzo(a)anthracene	mg/kg	MCERTS
Chrysene	mg/kg	MCERTS
Benzo(b)fluoranthene	mg/kg	MCERTS
Benzo(k)fluoranthene	mg/kg	MCERTS
Benzo(a)pyrene	mg/kg	MCERTS
Indeno(1,2,3-cd)pyrene	mg/kg	MCERTS
Dibenzo(a,h)anthracene	mg/kg	MCERTS
Benzo(g,h,i)perylene	mg/kg	MCERTS
Total PAHs (sum USEPA16)	mg/kg	MCERTS

Aliphatic TPH >C5 - C6	mg/kg	MCERTS
Aliphatic TPH >C6 - C8	mg/kg	MCERTS
Aliphatic TPH >C8 - C10	mg/kg	MCERTS
Aliphatic TPH >C10 - C12	mg/kg	MCERTS
Aliphatic TPH >C12 - C14	mg/kg	MCERTS
Aliphatic TPH >C16 - C21	mg/kg	MCERTS
Aliphatic TPH >C21 - C35	mg/kg	MCERTS
Aliphatic TPH (C5 - C35)	mg/kg	MCERTS
Aromatic TPH >C5 - C7	mg/kg	MCERTS
Aromatic TPH >C7 - C8	mg/kg	MCERTS
Aromatic TPH >C8 - C10	mg/kg	MCERTS
Aromatic TPH >C10 - C12	mg/kg	MCERTS
Aromatic TPH >C12 - C16	mg/kg	MCERTS
Aromatic TPH >C16 - C21	mg/kg	MCERTS
Aromatic TPH >C21 - C35	mg/kg	MCERTS
Aromatic TPH (C5 - C35)	mg/kg	MCERTS

Carbon tetrachloride	µg/kg	ISO 17025
Dichloroethene, 1, 2-	µg/kg	ISO 17025
Dioxin (2,3,7, 8-tcdd)	µg/kg	ISO 17025
1,1,1-Trichloroethene	µg/kg	ISO 17025
Tetrachloroethene	µg/kg	ISO 17025
1,1,1,2-Tetrachloroethane	µg/kg	ISO 17025
1,1,2,2-Tetrachloroethane	µg/kg	ISO 17025
1,1,1-Trichloroethane	µg/kg	ISO 17025
Trichloroethene	µg/kg	ISO 17025

Asbestos	N/ND	ISO 17025
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Sample 1		
2		✓
3		✓
2		✓
7		✓
36		X
34		✓
16		X
95		—
S		—
3		X
0		✓
0		✓

1.1	X
39	✓
8.7	X

8.5	X
481	✓
2456	✓
2.7	—

3.2	X
0.13	✓
14	✓
38	✓
524	✓
65	✓

2.7	✓
< 0.2	✓
6.8	✓
< 4.0	✓
9.2	✓
7.5	✓
< 0.3	✓
7.8	✓
< 1.0	✓
18	✓
1.1	✓
< 1	✓
< 1	✓
< 1.0	✓
0.025	✓
180	✓

< 0.05	✓
< 0.10	✓
< 0.10	✓
< 0.10	✓
< 0.10	✓
< 0.10	✓
< 0.10	✓
< 0.10	✓
< 0.05	✓
< 0.10	✓
< 0.10	✓
< 0.10	✓
< 0.10	✓
< 0.05	✓
< 1.60	✓

< 0.1	✓
< 0.1	✓
< 0.1	✓
< 1.0	✓
< 2.0	✓
< 8.0	✓
< 8.0	✓
< 10	✓
< 0.1	✓
< 0.1	✓
< 0.1	✓
< 1.0	✓
< 2.0	✓
< 10	✓
< 10	✓
< 10	✓

[illegible]

Not-detected	✓
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Results of analysis should be read in conjunction with the report they were issued with

### Visual Examination

The sample was described as dark yellowish brown (Munsell Colour 10YR 4/4), slightly moist, friable SAND with a single grain and weakly developed fine granular structure. The soil was virtually stone-free, and contained occasional organic fines. No unusual odours, deleterious materials, roots or rhizomes of pernicious weeds were observed.

✓	Compliant with 2.4 Material Selection - Subsoil - Remediation, Bulk Excavation and Fill ITP, Olympic South Park 15/014/12 ITP01 and Capita Symonds Site Specific Assessment Criteria - Human Health - Zone PDZA: Allotments
X	Fails 2.4 Material Selection - Subsoil - Remediation, Bulk Excavation and Fill ITP, Olympic South Park 15/014/12 ITP01 and Capita Symonds Site Specific Assessment Criteria - Human Health - Zone PDZA: Allotments
*	See report comments

Horticultural parameters analysis carried out by Natural Resource Management Ltd - UKAS No. 2334  
Contamination analysis carried out by i2 Analytical Ltd. UKAS - No. 4041

BSc MSc PhD  
Soil Scientist

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